National Aeronautics and Space Administration

M Dwarfs as Desirable Targets for Planet Searches

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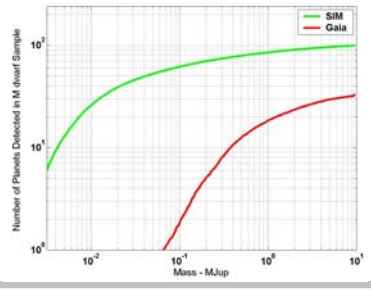
Project Objective

The odds are good that the first truly terrestrial or rocky planet will be found around an M dwarf. The purpose of this poster is to review present and future planet search surveys around M dwarfs with

- Astrometry
- Radial Velocity
- Transits
- Direct Imaging

Recent Results

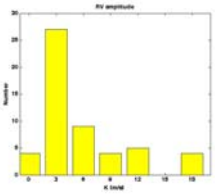
SIM vs Gaia - Around the nearest 100 M dwarfs, SIM would be able to detect a hand full of Earth mass planets and all planets up to 10 M_J. Gaia will be able to detect down to almost a Neptune mass planet but not detect planets around all stars in the M dwarf sample.



Ground

Radial Velocity

- Endl et al. (2006) Looked at 90 M dwarfs with RV precision of ~2.5 m/s and found no planets with Msini>3.8 M_J at a < 0.7 AU
- Externally dispersed interferometers (EDI) are being designed to achieve <5 m/s precision in 10 minutes for H≥10 (Edelstein et al. 2007)



RV amplitude of a sample of 60 nearby M dwarfs with $1M_\oplus$-$1M_J$ planets in the HZ

- M dwarf survey with TEDI has begun at Palomar (J. Lloyd, PI)

Astrometry

- STEPS is an astrometric survey of M dwarfs at Palomar (Pravdo et al. 2006, Shaklan poster)
- RECONS survey has been monitoring M dwarfs for a few years to get dynamical masses (T. Henry, PI)
- Future Carnegie and Palomar surveys are aiming for 100 μas accuracy (Cameron et al. 2008)
- Future ground-based astrometric surveys could get down to 10 μas single measurement accuracy (I.e. Keck/VLT, Lazorenko et al. 2007)

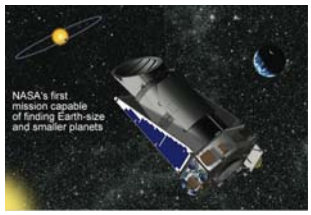
Transits

Charbonneau's MEarth project will target 2000 late-type M dwarfs with 10 30 cm telescopes over 3 years 2.6 planets for 10% occurrence rate Nutzman & Charbonneau (2007)

Space

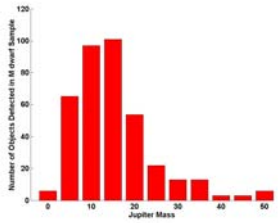
Transits

Kepler will now include a substantial sample of M dwarfs in its target list. Primary/ secondary eclipses and phase curves will be accessible



Astrometry

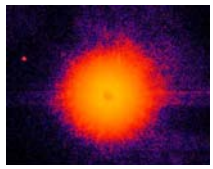
Kepler will be able to astrometrically detect Jupiter-mass planets and brown dwarfs around the ~10K or so M dwarfs expected to be in its FOV.



Masses for astrometrically detected M dwarf companions in the Kepler FOV

Direct Imaging

- JWST - should be able to image 1 M_J planets around mid-late type Ms
- TPF - will look for terrestrial planets but the IWA of the HZ may be of concern
- Both will benefit from astrometric M dwarf surveys



M dwarf GL 15b and its non-companion

- The limits of RV and astrometric measurements due to stellar starspots and flares have not been fully assessed

Benefits to NASA and JPL

- M dwarfs will be important targets for a number of JPL missions including Kepler, SIM PlanetQuest and TPF.
- Ground based astrometric M dwarf surveys with Palomar are underway and an IR RV commissioning survey with Palomar/TEDI has just begun

Publications

Cameron, P.B., & Kulkarni, S.R. 2007, American Astronomical Society Meeting Abstracts, 211, #144.02
Endl, M., Cochran, W.D., Kurster, M., Paulson, D.B., Wittenmyer, R.A., MacQueen, P.J., & Tull, R.G.2006, ApJ, 649, 436
Edelstein, J., et al. 2007, ArXiv e-prints, 710, arXiv:0710.2132
Nutzman, P., & Charbonneau, D. 2007, ArXiv e-prints, 709, arXiv:0709.2879
Pravdo, S.H., Shaklan, S.B., Lloyd, J., & Benedict, G.F. 2005, ASP Conf.Ser.338: Astrometry in the Age of the Next Generation of Large Telescopes, 338, 288
Lazorenko, P.F., Mayor, M., Dominik, M., Pepe, F., Segransan, D., & Udry, S. 2007, A&A, 471, 1057